ENHANCING BEST PRACTICE IN PUBLIC HEALTH: USING PROCESS PATTERNS FOR BUSINESS PROCESS MANAGEMENT

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Abstract

Business Process Management (BPM) is often perceived as a top priority concern in organisations; both in public and private sectors. Process modeling is an embedded component of most BPM initiatives, yet a resource intensive task. How process models can be derived efficiently (i.e. with less resources and time) and effectively (at a high quality to meet the specific needs) is an integral element of interest to most organisations, however, this area of research is still in its infancy. This paper aims to address this gap by proposing a 'process-pattern' based approach to process modeling.

The overall study design consists of an action research approach, depicting how the proposed process pattern concept has been derived and evaluated within an Australian based public health institution. The contributions from this work are twofold. From the perspective of practice, it offers a validated high level process pattern for health services management projects. From an academic perspective: it presents a validated health services process pattern which can be used as best practice or a benchmark in further research. The action research method applied within can also be re-applied to design and validate further process patterns within different contexts.

Keywords: process patterns, process modeling, action research, business process management, public sector.

1 INTRODUCTION

Business Process Management (BPM) is often perceived as a top priority concern in organisations; both in public and private sectors (Gartner Group 2005). BPM in general, includes methods, techniques, and tools to support the design, enactment, management and analysis of business processes (van der Aalst et al., 2003). "*In addition to the problems rooted is the lack of a common view point on BPM and its potential advantages and pitfalls, organizations find that they face a wide range of other, often unexpected, challenges when embarking on BPM projects*" (Indulska et al., 2006). One of the key concerns and challenges when applying BPM is the lack of accepted methodologies, and resources to guide these initiatives (Larsen and Myers, 1998; Murphy and Staples 1998; Amoroso, 1998).

A common BPM methodology that can be utilised and catered for all specific contexts is yet to be derived; and may not be feasible due to the complexities that each individual context brings in. However, a common aspect of all BPM approaches is the orientation towards understanding the current-processes and aim towards an improved better-process. In order to achieve the benefits of BPM initiatives, it is critical that organisations "*first outline the business drivers for BPM, articulate the targeted processes, and have a clear agenda on deployment strategies*" (Indulska et al., 2006). Best practice documentation and process modeling play an integral part in this.

The term 'Best Practice' is used to describe the process of developing and following a standard way of doing things that can be used (i.e. for management, policy, and especially software systems development) by multiple times. Even though the term 'best practice' has now become a buzz word within organizations, it is not a new notion. For example, Frederick Taylor (1911) stated that *"Among the various methods and implements used in each element of each trade there is always one method and one implement which is quicker and better than any of the rest*" (Taylor, 1911). Best practices is ideally, defining ways that can be used to get things done based on past experience. Organizations benefit by adapting these, as they assure quality results and consistency when the process is followed. Today, 'best practices' are documented in various forms, such as in reference models and information libraries (i.e. SCOR, ITIL, PMBOK, ETOM etc) and are accepted more as 'better-practice', that can assist organizations to define, design, implement and monitor business process improvement initiatives. These documented best practices often use graphical models to illustrate the methods to follow.

Process modeling is an approach for visually depicting how businesses conduct their operations by defining the entities, activities, enablers and further relationships along control flows (Curtis et al., 1992; Gill, 1999). It is widely used to increase awareness and knowledge of business processes, and to deconstruct organizational complexity (Davenport, 1993; Hammer and Champy 1993; Smith and Fingar 2003). The visualization of business processes in the form of process models has increased in popularity and importance (Bandara et al., 2005). Process modeling is an embedded component of most BPM initiatives, yet a resource intensive task (Becker et al., 2003). "*The importance of business processes has been amplified by being in the centre of late technological inputs in the form of ERP and workflow systems that aim at increasing productivity and functional interconnectivity by automating internal and external transactions*" (Adamides and Karacapilidis, 2006). Thus, how process models can be derived efficiently (i.e. with less resources and time) and effectively (at a high quality to meet the specific needs) is an integral element of interest to most organisations. This area of research is still in its infancy, with only a few studies conducted on critical success factors of process modeling (e.g. Bandara et al, 2005). Even these, (while they depict what the critical success factors are with empirical evidence) do not provide procedural guidelines on how to achieve these success factors, to improve the efficiency and effectiveness of process modeling initiatives. The driving force of this paper is to contribute to addressing this gap; to address the research question; "***Can process models be derived successfully by applying process patterns****?"*

The study unit-of-analysis is the 'process modeling project', which encompasses the models (the output) and the process of deriving the models. In the context of this study the process modeling project is considered a success if it is *effective and efficient.* A process modeling project can be considered *effective* to the extent it fulfils its objectives. A process modeling project can be considered *efficient* to the extent that process modeling activities are completed with the allocated resources (such as time, effort and budget) (adapted from Bandara et al., 2005).

In this paper, we propose a "pattern-based" process modeling approach, as a means of achieving process modeling success. Empirical evidence, gathered through an action research model, of applying this approach within a public health organisation is the main foci of this paper. In order to introduce the outcomes of the study, the paper is structured as follows. First, an overview of the 'process patterns' concept is provided. Next the study design which applied an action research methodology is presented. The paper presents the study findings, as it unfolds, with each phase of the study design, illustrating how the pattern based approach was developed and tested within a leading public-health organisation of Queensland, Australia. Finally, the paper concludes with a discussion of the limitations, as well as a preview of future research.

2 INTRODUCTION TO THE CONCEPT OF 'PROCESS PATTERNS'

A pattern in general is "*an abstraction from a concrete form which keeps recurring in specific non-arbitary contexts*" (Riehle and Zullighoven, 1995). Patterns have been usefully applied across different disciplines in the past. Alexander et al., (1977) describes how patterns can be used for building architectural designs. Patterns have been widely applied in the Software development arena since the "Gang of Four" (GoF) patterns were introduced by Gamma et al., (1995), they have also been widely applied in the workflow management arena (see http://worekflowpatterns.com for further details). Recent research (i.e. Van der Aalst et al, 2003) has proposed the use of patterns for the description and evaluation of workflow management technologies. Forster (2006) describes potential business process improvement options across different layers of an organisation using a pattern approach. Literature predicts the high proliferation of patterns within the BPM arena (Harmon, 2003).

The basic benefit of a pattern is that the fundamental elements can be reused and hence better knowledge management, efficiency and effectiveness reached, when they are applied within projects. Patterns can be seen as *building blocks*, which when put together form a meaningful entity with minimal effort. However, the knowledge (held by the person applying the patterns) of how to, and when to bring them together plays a critical role for its success. Patterns can also be perceived as *standard recipes*, where the basic fundamental concepts can be adapted and catered for to meet specific needs.

Within a BPM context, a pattern is "*an idea that has been useful in one practical context and will probably be useful in others*" (adopted from Fowler, 1997, p.8). Hence patterns are not invented, rather discovered by observing its success over a number of applications. In other words, a process-pattern is a common approach to solve problems that are proven to work in practice (adapted from Ambler, 2000). Process patterns are different to reference models (such as SCOR, ITIL, PMBOK etc) – which have been applied widely for process improvement projects. "*A reference model is an abstracted depiction of reality that serves as a standardised or suggestive conceptual basis for the design of enterprise specific models, usually within a like domain*" (Taylor, 2003, p. ii). A pattern has a much smaller focus, and can be a part of a reference model. While process patterns may inherent some features of reference models, they do not provide 'enterprise' solutions, rather provide process specific solutions, which are much smaller in scope. Process patterns can be usefully applied across the various phases of a BPM project.

3 STUDY DESIGN AND FINDINGS

An action research method was chosen for this research, with the goal of producing immediate practical and academic outcomes. The principal researcher led the proposed pattern design and application project and played an integral role within the research settings. "*Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework*" (Rapoport, 1970, p.499). It also assists to "*develop self-help competencies of people facing problems*" (Susman, and Evered, 1978, p.588). It is a scientific research method that has its roots and methods well established since Kurt Lewin (1946) first introduced the term 'action research' as the pioneering approach towards social research (cited in Susman, and Evered, 1978, p. 586).

The primary researcher of this project was the business analyst working in an ICT Service group, in a Queensland government agency. The ICT service group was responsible for providing business system development support for a large tertiary teaching hospital in, Queensland, Australia[1]. The researcher's primary role was to review clients' business processes in order to document their requirements for enhancement or replacement of ICT solutions. BPM and ICT initiatives within the agency had a history of taking took too long with the traditional analysis and documentation approaches used, where the analyst always started from scratch. The researcher, within an action research framework, looked for repeatable behaviours in the types of requests for business analysis and explored the use of a 'process pattern' to reduce the time to complete the analysis activities.

While different studies classify action research in various ways, most action research follow the traditional 'plan-do-check' approach (Chein et al., 1948). We have adapted the Susman, and Evered (1978) five phased action research model, following an 'experimental action research' approach (Chein et al, 1948; Susman, and Evered, 1978). The five core phases are; (i) diagnosing, (ii) action planning, (iii) action taking, (iv) evaluating, and (v) specifying learning. The next sections will describe each of these phases in detail.

3.1 Diagnosing

This phase is primarily identifies and defines and problem. Public administrations are increasingly experiencing the need for disclosing their processes and proving the efficiency of their occupation. Process modeling methods have proven to be an adequate mechanism in order to achieve transparency, but process modeling projects can be very expensive and time consuming, often with many external consultants involved (Becker et al, 2003). Thus, a high level framework (pattern) to depict the major process tasks and flows is proposed as a useful way to get started.

The delivery of health treatment services in Australia are the responsibility of State government agencies. Australian Health treatment services organisations are accredited by the Australian Council for Health Care Services (ACHS[2]). Health services are typically delivered through hospitals, clinics and, community care facilities such as aged care and nursing homes. The definition of policies and procedures for delivering health treatment services varies between states from having central corporate-office models to de-centralised models. The core accreditation service is delivered through the Evaluation and Quality Improvement Program (EQuIP). The EQuIP framework which supports a continuum of care model describes the processes that should be implemented to deliver high quality health treatment services. EQuIP was launched in 1996 providing Australian health care organisations

[1] Please note the further details about the case organisation that may identify it's identify has been removed from this paper in order to adhere to the confidentiality agreements made with the participating organisation and researchers.
[2] See http://www.achs.org.au/display.aspx?PageID=0&MemberID=0&screenwidth=1024#, last accessed November 22nd, 2006, for further details.

with a framework to deliver a consumer-centred service focusing on the continuum of care by incorporating systematic external peer review. Close to 800 organisations across Australia were accredited over a four year cycle with the aim of improving the delivery of health treatment services. The ACHS-EQuIP model prescribes a continuum-of-care framework that starts when a patient requests care, to the point when the patient no longer requires care or is discharged and covers the delivery of all Health Treatment Services. Figure 1, depicts (via a process pattern) the high-level process captured by this framework, which consists of the primary areas of; Access, Assess, Care planning, Treatment, Review and Discharge. These areas are briefly described in Table 1.

CORE PHASES	DESCRIPTION
Access	A member of the public can access the Health Treatment Service at a point of service at any health facility. The request for service may simply be a request for information about a service or the service provided itself.
Assess	To ensure a comprehensive assessment is performed, qualified and competent staff are involved in assessing the patient's/client's status.
Care Planning	A coordinated plan of care, incorporating goals, is developed through collaboration with patients/clients, carers and the health care team to achieve desired outcomes.
Treatment	Care delivery is coordinated and provided according to the needs of the patient/client, and the plan of care.
Review	Care delivery is evaluated by the health care team to ensure the care continuously meets patient/client needs and assists in the improvement of care provision.
Discharge/ Close Treatment Service	Patients/clients and carers are prepared for, and are confident about, the continuing management of the patient/client on leaving the organisation. The patient's treatment service notes are collated and the service summary is created. The patient's medical record is updated and the signed service summary sent to the patient's primary care provider.

Table 1: Overview of the core process areas of the High level Patient care health pattern

3.2 Action planning

Alternative courses of action for solving a problem are considered in this phase. Documenting business requirements is essential to understanding and selecting the most appropriate solution for the business. Process models are often used as a tool to understand the way the business works and to document the way the business want to transform. The alternatives considered to document business requirements using a process-modeling approach were mainly two fold:

Approach 1: Maintain the status quo or re-draw process models each time a process modeling exercise is undertaken.

This is the most common method of documenting business requirements. The advantage of such an approach is that one starts without any preconceived notions or assumptions about the business area being reviewed. The disadvantages however, are that the time taken to document requirements is

lengthy, often results in scope creep and wears the stakeholder group from having to provide input into numerous simultaneous projects.

Approach 2: Discover a process pattern

A process pattern could be derived by talking to relevant stakeholders; in particular practitioners and quality-control managers. A process pattern can also be developed through reviewing organisation policy, procedures, work instructions, standards etc, which often describes process constraints.

This approach also has some of the disadvantages discussed above (i.e. requires time and resources), but if an architecture approach[3] is taken to documenting the pattern, then the pattern repository[4] will be effectively populated as the number of projects grows.

Approach 2 was selected due to the anticipated efficiency and effectiveness in the overall modeling outcome.

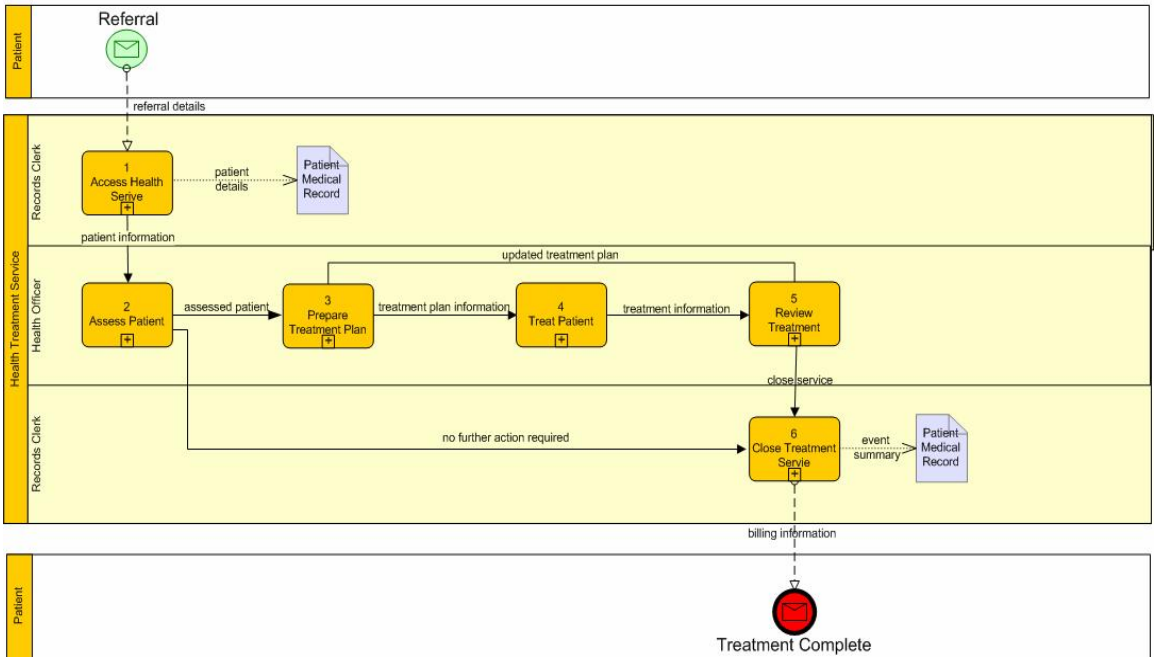

Figure 1. The EQuIP framework content in a high-level process pattern

3.3 Action taking

This phase deals with the selection of some form of action and the actual implementation of it. Given that it is difficult to get access to subject matter experts, especially in a clinical environment, the approach taken to make the business analysis project more effective was to have a process pattern already in place before consulting with the stakeholders. This approach involved a detailed review of how the services were delivered to patients. A top-down approach was designed for this purpose. The researcher reviewed the Health organisation's strategic information to firstly understand how the

[3] This (the concept of process architectures) is discussed in detail in section 3.5. By definition, it is an approach to pre identify the different levels of abstraction of the target process models; where each level of abstraction pertains to a specific view or perspective (Green and Ould, 2004)

[4] A pattern repository is a collection of patterns maintained in an organised manner within a repository. This too is discussed in detail later in the paper, in section 1.5.2.

organisation delivered Health Treatment Services. Next, policies relevant to the delivery of treatment services were examined to get an understanding of how the treatment service providers enacted the processes which deliver services within the organisation constraints (business rules). It soon became apparent that providing quality treatment services was a high level corporate goal along with treating patients with a 'continuum of care' focus. One of the mechanisms used to ensure that all treatment service providers delivered a high quality of care was to have accreditation through the ACHS EQuIP body every four years. This approach meant that each treatment service provider manages and maintains a robust quality management system. The quality processes are based on a 'continuum of care' framework and the focus of the service is on the patients.

Based on the preliminary research conducted at the early stages of this phase, a process pattern was documented, that described the 'Continuum of Care' to deliver health treatment services to patients (refer to Figure 1 for an overview[5]). Although the research was a time consuming exercise, the development of the pattern was relatively quick as a Health Information Management expert was approached to support the documentation and validation of the pattern. The pattern was then tested on the next business analysis project assigned to the researcher with the various stakeholder groups identified in the process pattern, who came from an Oncology treatment service area.

The Oncology unit was an ideal test case as the service itself was made up of not only out-patient and in-patient services by had different types of Oncology services being delivered to patients. These were delivered through Haematology, Radiation Therapy, Surgical Oncology, Medical Oncology, Palliative Care, Gynaecologists specialists and Allied Health Workers. In addition to this, the services were delivered across two different hospitals.

With a pattern-based process modeling approach been taken, the business analyst developed a separate process model for the in-patient, out-patient, Haematology, Radiation Therapy, Surgery, using one or more scenarios, with one set of process models covering each scenario for each hospital. At least 12 sets of process models would have been drawn to describe the delivery of Oncology Treatment services but only one set was required and used by the analyst with the application of process patterns. Typically such projects take life between three to six months (as evidence from archived past project documentation), however, the process pattern approach enabled the researcher complete the project in two weeks. Adopting a pattern-based approach allowed one model (pattern) to be used to validate the process at each site and for each service with the analysis focusing on the similarities and differences between them.

3.4 Evaluating

This phase is dedicated to studying the consequences of the action(s) taken. As discussed earlier, the pattern based approach was very effective to meet with accelerated time frames and provide quality process models. However, this is not to say that the approach is without its limitations. Some of the limitations identified through reflection and observation were as follows:

- No process architecture in place.

The non existence of a process architecture meant that the researcher had to develop the process architecture as the project evolved. The process of discovering and developing patterns would have been more efficient if an architecture and hence, a structure, defined for discovering and developing patterns was already in place.

[5] The derived health care process pattern has more detailed process patterns at lower levels for each of the main areas in the pattern (i.e. Access, Assess, Care planning, Treatment, Review and Discharge) and their sub-areas. These have not been discussed in detail in this paper due to space constraints.

- Organisational cultural hindrances

Typically in large organisations, stakeholders believe that their process is 'different' or unique and thus, do not lend itself to things that may seem 'generic'. Patterns on the other hand are generic forms of information (derived through the extraction on what keeps on recurring within certain contexts). A process pattern is a successful tool to initially focus on the similarities in the process (and not the differences). When the pattern based approach was applied with the Oncology stakeholders, the idea of being too unique hindered its acceptability and created resistance. However, once it was shown that only the intervention portion (the actual medical treatment) which is part of the patient treatment process (refer to Figure 1) is unique, and the rest of the process within Oncology is the same as with all other medical treatments, the pattern based approach was accepted and adapted.

In addition to self reflection and observations, evaluative data were gathered through formal feedback through a series of interviews. Clients were asked to provide feedback on the approach taken during the project and post-project. Clinical and non-clinical staff positively commented on the reduction in time taken to complete workshops without the need to consume significant amounts of Subject Matter Expert time. Remarks were made on the quality of the business analysis artefacts, mainly due to the fact that the researcher could spend more time on reviewing the process models, conducting detailed analysis and providing recommendations for improving the business. A range of specific organisational benefits of using a pattern approach were stated during these interviews. They are briefly summarised below.

- ***Better control on how things are done:*** An organisation can reduce overhead costs by analysing the most efficient and effective way to implement a business process. This process pattern can then be implemented right across the organisation to conduct all relevant processes in a consistent way.

- ***Clearer requirements definitions for Enterprise solutions:*** An organisation should first document the current business process for the ideal scenario (in a pattern) and use this model (the pattern) to examine the differences between business areas to the pattern/ ideal scenario. Significant differences can then be analysed and decisions made to standardise the processes (to-be pattern) and define requirements for the Enterprise solution.

-***Audit for Compliance*****:** Quality management systems typically use policy, procedures and work instructions to conduct audits. Audits consist of checks to see if a process has been implemented the way it is supposed to. A pattern repository can enable the organisation to assign benchmarks to the pattern and assist audit the business area based on the benchmark.

- ***Communication and transparency on how things are done*****:** Training staff consistently to do the same thing the same way can be challenging, especially in large organisations. A pattern based approach can be adopted where the process pattern is used to develop training material.

3.5 Specifying learning

The goal of this phase is to identify potential improvements for repeated projects, based on the observations made from the current project. Seven main issues were identified as major areas to be addressed when applying a pattern based approach. They were classified as high and low level requirements. *High level requirements* related to the elements that were important at a project level when implementing a pattern based approach and included (a) the application of process architecture, (b) the creation of a pattern repository, and (c) the documentation of pattern governance and ownership. The *low level requirements* were those elements that related to the individual patterns and consisted of; (d) having different level of abstraction, (e) fragmentation, (f) embedded flexibility and (g) context specification.

3.5.1 High level requirements

- Application of a process architecture

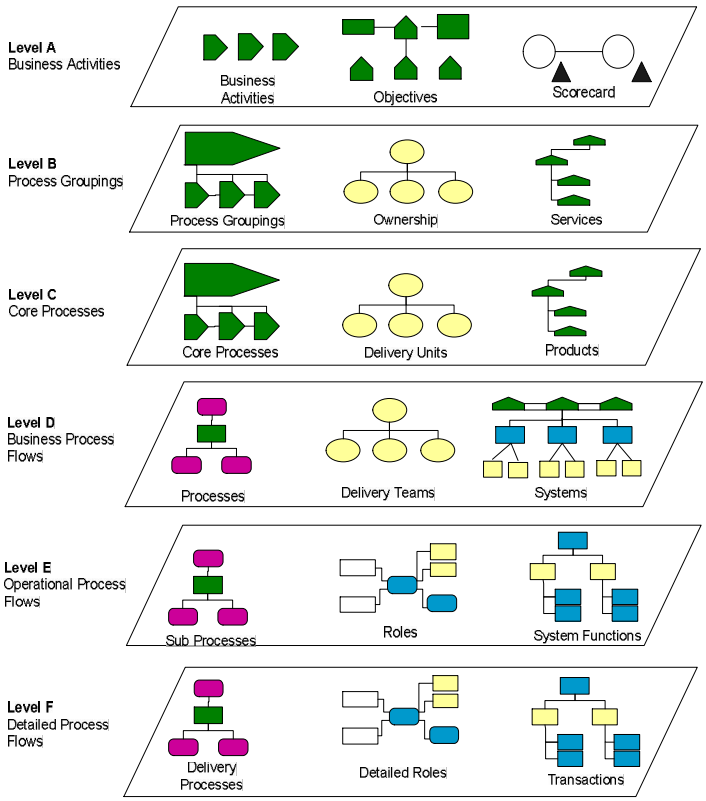

Figure 2: Process Architecture Framework (Davis,2006)

A process architecture defines a framework for organising, deriving, managing and maintaining the process pattern. A process architecture organises the processes so that employees can easily adopt a pattern based approach to their work as this provides them with a structure to manage their business analysis projects. The process archetecture model (later) adopted in thus study is shown in Figure 2. This is the architectural process modeling approach proposed by (Davis, 2006) which is also applied across British Telecom. This model provides a top down approach using six layers from A to E (see Figure 2 for details on each layer) where the level of detail represented by the process models increases from top to bottom. Process patterns can be identified at each level of the model which is actually the 'architecture' of the organisation.

- The creation of a pattern repository

The processes and the frameworks have to be stored somewhere in order for people to access them. These repositories should store the pattern models, the meta models and the processes on how to use the meta models.

- Pattern governance and ownership

Governance processes should dictate who the pattern owners are and ensure that the patterns are reviewed regularly, so that they don't end up becoming shelfware. Changes in the business environments are inevitable, the impact of these changes on the process patterns should be evaluated periodically to ensure the pattens continue to be 'best practice'.

3.5.2 Low level requirements

- Maintain different levels of abstractions

Every process pattern has to fit with the process architecture, otherwise its applicability within the organisation becomes vague. Thus, each pattern must be within the layers of the process architecture, with clear meta-data on which perspectives it captures and the degree of detail it entails.

- Maintain fragmentation (for reuse)

Large scale process modeling projects are often conducted in a piece mental manner (Green and Ould, 2004). End to end processes can be broken down to fragments, where each fragment can be depicted by a process pattern , which can be adapted seperately. While fragmentation, and structured layering of process patterns is important, an overaching structure (a high level pattern) to depict how these fragments fit together is very important.

- Allow flexibility and context specification

Flexibility has to be maintained within the patterns to allow minor changes to fit the process/ context . Issues related to flexibility has to be integrated into the guidelines on how to use the patterns (i.e. *'how can one expand and edit the models*?' has to be described within the pattern deployment guidelines). What is a detailed pattern within a certain context can be extracted at a higher level, which can be then used as a pattern at a higher level across any context (e.g. delivering a treatment in health vs a generic delivery of service). The higher the pattern sits in the Process Architecture (refer to figure 2, Level (i.e. A, B C) compared to lower levels (i.e. D, E, F), the more context free it is and hence the more flexible it should be.

4 LIMITATIONS, OUTLOOK AND CONCLUSION

This paper proposed a pattern based approach for enhancing business processes, when conducting modeling based BPM projects. The study followed an action research approach within a reputed public heath organisation, in Australia. It first presented an introduction to the research context, followed by an overview on the concept of process patterns. The research design and findings within each phase were then presented unfolding the story of how the research conclusions were obtained.

The study's findings are of benefit to both the BPM research and practicing communities. To the authors' best knowledge, this paper introduced the concept of process patterns for the *first time* with empirical evidence on the pattern derivation and application processes. While it is acknowledged that the application of patterns is not a new concept, and many are already using patterns, we argue that most are not aware of it, and hence do not put into practice the full potential of process patterns. This paper is expected to have contributed to filling that gap by illustrating the process patterns' benefits within a detailed case narrative. In particular, the paper depicted how process patterns can be used to (i) maintain a central knowledge base of the processes that are conducted, (ii) derive a 'standard' to the services across geographically dispersed organizational units, and (iii) identify possible opportunities/ threats by comparison techniques.

The study is not without its limitations. Process patterns are presented here as 'best practice' (or 'better practice'); as a possible 'standard' that can be followed within a particular setting or context. Past evidence has shown that the adoption of such standards is hindered by lack of stakeholder awareness and lack of perceived usefulness. Furthermore, process patterns are relevant only to document a certain limited high-level process flow, and there is a fair amount of skill that is required by the adoptee of the patterns to usefully apply it in a given context. Process patterns can have

embedded constraints based on organisational policies, legislations, culture and varying structures. The notion of 'best practices' does not commit people or companies to one inflexible, unchanging practice, instead, best practices is a philosophical approach based around continuous learning and continual improvement, hence the process patterns need to be continuously reviewed and updated.

The results reported in this paper are the first steps towards depicting the value of a pattern based approach for better BPM within the public health context, and further improvements to the reported findings are underway. Means of increasing the awareness of the benefits and buy-in for process patterns (to increase their adoption and proliferation) has to be conducted. More empirical data can to be collected for triangulation purposes in the evaluation phase of the study design. 'Usability' testing (in the form of extended empirical tests) to identify what further details can be provided to support the adoption of these patterns within specific contexts needs to be addressed. In particular, the integration of context specific information within the process patterns (Rosemann, 2006) will be useful to support the adoption of these high-level process patterns within the specific, detailed processes of an organization. While the process patterns provide a useful body of knowledge, this should be owned and managed by a process-pattern-owner in order to sustain its currency and usefulness in this ever - changing environment.

References

Adamides E., D., and Karacapilidis, N. (2006). "*A knowledge centred framework for collaborative business process modeling"*, Business Process Management Journal, Vol**:**12 **(**5), pp. 557 – 575.

Alexander, C., Ishikawa, S. and Silverstein, M., (1977). "*A Pattern Language: Towns, Buidlings, Construction*", New York: Oxford University Press.

Ambler, S. (2000) "*Reuse patterns and antipatterns*". Software development.

Amoroso, D. L. (1998). "*Developing a model to understand Reengineering project success*", IEEE.

Bandara, W., Gable, G. G., and Rosemann, M. (2005). "Factors and measures of business process modeling: Model building through a multiple case study". European Journal of Information Systems, 14, 347-360.

Becker, J., Kugeler, M., and Rosemann, M. (2003). "*Process Managament - a guide for the design of business processes*" , springer, Berlin et al.

Chein, I., Cook, S., W., and Harding, J. (1948). "*T*he field of action research" American Psychologist, 3:pp 43-50.

Curtis, B., Krasner, H., and Iscoe, N. (1988). "A field study of the software design process for large systems". Communications of the ACM, 31(11).

Davenport, T. (1993). "*Process innovation: Reengineering work through information technology*": Harvard Business School press.

Davis. R. (2006). "British Telecom - Six-Level Process Hierarchy", in proceedings of the Process days conference , Sydney, August 22-24, 2006.

Forster, F. (2006). "*The idea Behind Business Process Improvement: Towards a Business Process Improvement Pattern Framework*". Business Process Trend Advisor; 04-06.

Fowler, M. (1997). "*Analysis Patterns: Reusable Object Models*", (Vol. Reading), Addison-Wesley.

Gamma, E., Helm, R., Johnson, R. and Vlissides, J. (1995). "*Design Patterns: Elements of Re-usable Object- Oriented Software*", Addison – Wesley.

Gartner Group (2005). "*Delivering IT's Contribution: The 2005 CIO Agenda*", Stamford, Connecticut, Gartner, Inc.

Gill, P., J. (1999). "*Application Development: Business Snapshot -Business Modeling Tools Help Companies Align Their Business and Technology Goals*". Information Week.

Green, S., and Ould, M. (2006). "The primacy of process architecture", available at http://www.csm.uwe.ac.uk/~sjgreen/paper2.pdf, last accessed Nov 22nd.

Hammer, M., and Champy, J., M. (1993). "Reengineering the corporation: a manifesto for business revolution". London: Nicholas Brealey Publishing, Allen and Urwin.

Harmon, P. (2003). "*Business Process Change: A Manager's guide to improving redesigning, and automating processes*". Amsterdam, Boston: Morgan Kaufmann.

Indulska, M., Chong, S., Bandara, W., Sadiq, S. (2006). "*Major Issues in Business Process Management: An Australian Perspective*", to be presented at the Australian Conference on Information Systems (ACIS 2006).

Larsen, M., A., and Myers, M., D. (1998). "BPR Success or failure? A business Process reengineering project in the financial services industry". Communications of ACM, 367-381.

Murphy, F., and Staples, S. (1998). "Reengineering in Australia: Factors affecting success". In proceedinsg of the Australasian Conference of Information systems, Sydney, Australia.

Rapoport, R., N. (1970). "*Three dilemas of action research*". Human Relations, 23, 499-513.

Reihle, D., and Zullighoven, H. (1995). "A pattern Language for tool construction and integration based on the tools and materials metaphor", In J.O Coplian and D.C Schmindt (Eds.), Pattern Languages of Program Design, Addison Wesley Professional.

Rosemann, M., (2006). "*Understanding Context-awareness in buisness process design*", to be presented at the Australasian Conference on Information Systems, Dec 6-8 Adelaide.

Smith, H., and Fingar, P. (2003). "*Business Process Management. The Third Wave*". Tampa: Meghan-Kiffer Press.

Susman, G., and Evered, R. (1978). "*An assessment of scientific merits of action research*", Vol 25, p 582-603

Taylor, C. (2003). "*Reference Models for IT service Provision*", Masters dissertation, Queensland University of Technology

Taylor, W., F. (1911). "*Modern History Sourcebook: The Principles of Scientific Management*", available online at http://www.fordham.edu/halsall/mod/1911taylor.html, last accessed, November 22nd, 2006.

Van der Aalst, W.M.P., ter Hofstede, A.H.M., Weske, M. (2003). "*Business Process Management: A Survey*" in proceedings of the International conference of Business Process Management, Eidhoven, The Netherlands, June 26-27.

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